

MEASUREMENT OF THE SURFACE CONDUCTIVITY POLLUTION .

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ABSTRACT

The measurement of surface conductivity or resistivity of external high voltage insulations is very interesting and suitable at working of transmission and distribution equipment of electric power especially on voltage levels 100 - 400 kV. This article describes the devices which enable us to carry out the continual measurement of the surface layer resistivity of sedimentation exhalates. This measurement is important also from environmental point of view, because it shows on the stage loading of environment.

1.INTRODUCTION

Insulation materials of external high-voltage equipment, especially on EHV levels, are exposed to the aggression activity of outside working factors. Besides temperature, pressure and UV radiation acts the pollution on insulants by solid, liquid and gas exhalations. These exhalations are produced not only by chemical and other industries, but also by electrical plants combustioning the coal with great content of sulphur. The most expressive effects of pollution on insulators and insulations are registred not only on places with high concentration of industry and energetics, but also in the greate distance from them. This pollution is distributed by air flow in the atmosphere.

2.EFFECT OF EXHALATIONS ON OUTSIDE INSULATION SURFACES

Industry atmosphere with great content of oxides of sulphur , nitrogen and carbon in cooperation with air humidity create aerosols of competent acids. These ones are

sedimentated on insulators surfaces at suitable conditions. There they are active with sedimentary solid exhalations which are partly soluble what causes the decrease of surface resistivity. On decrease of surface resistivity have great influence the year seasons which are characterized with certain temperature range, occurrence of rainfall (rain,dew,fog).The most defects occure in the form of flashover on spring and autumn when after the drier period are greater amount of rainfall and also occurrence of dew and fog what causes that in sedimentary layer of solid exhalations is a small amount of humidity which enables high conductive electrolytes to rise. Dew is equable created on the whole surface of insulators and also on the bottom side providing the increase of surface travel and break-down of wet path in the case of falling rainfall. It causes the rise of tracking currents and discharge processes on surface up to flashover and rise of arc which damages the chemically very resistant glass and ceramics of insulators [1].

3.MEASUREMENT OF SURFACE RESISTIVITY

For long term measurement and monitoring of surface resistivity there were developed more equipment which block schemes are on Fig.1 and Fig.2.

Solution on Fig.1 is used for long-term measurements on places with net voltage 230 V where distance between measuring insulator and apparatus is not longer than 30 meters

Connection according Fig.2 works without connecting line with transmission of information by high frequency path. It is used on places without net voltage 230 V and energy is from the charging battery. From the point of the time the utilization is limited by battery capacity. As measuring insulator is the most frequently used the plate insulator on which electrodes are connected the measuring circuits. Is we want to receive the equivalent values of surface resistivity it is suitable to installed the measuring insulator immediately on the beginning of service of insulators also in the case if the measurements will be realized later. The experimental results show that the course of change of surface resistivity is characteristical for certain specified meteorological situations (as rain,dew,fog,drizzle,snow). At dry weather also considerably polluted insulators have a high surface resistivity but already small humidity expresively decrease its value up to 10 000 ohms. Development of surface resistivity is episode sometimes existing only some minutes or sometimes - some hours.

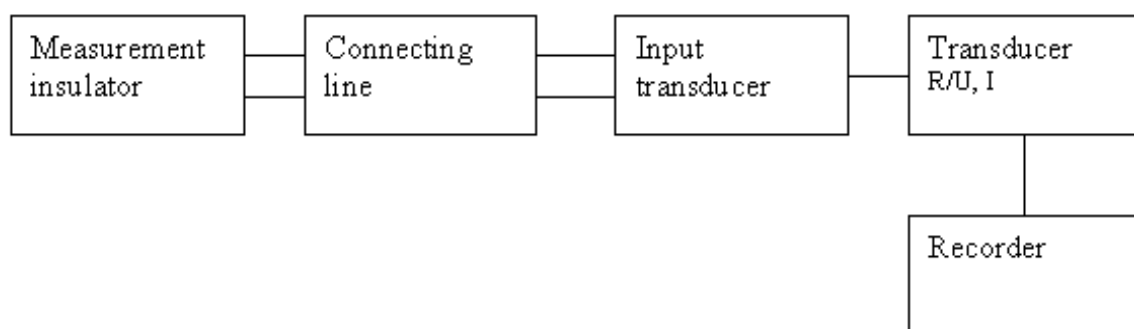


Fig.1

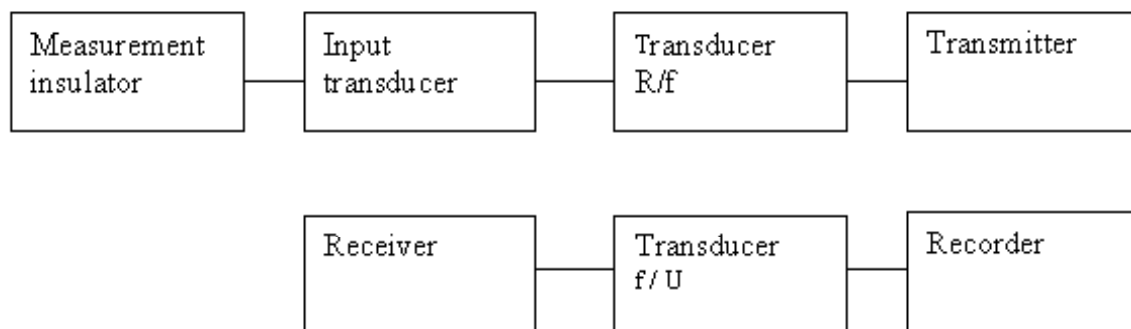


Fig.2

4. PRACTICAL APPLICATIONS

Developed equipment was directly tested in praxis at finding out the causes of frequent falls of 110 kV potential. It was found out that defects arise only on certain short section and repeatably, also after the change of insulators by new ones (type LS 75/21). Installed equipment after some days lasting measurement showed the periodical decrease of surface resistivity in early morning hours. By check in this time we found out the extreme occurrence of gas exhalations which were spreaded throughout the mountain country from the chemical plant located in cca 5 km distance.

Another application was realised at near 220kV substation at nuclear power plant. This substation had frequently falls in consequence of flashover on insulators. This situation was repeated also after change of insulators. Insulators were clean without visible dust fall. Installed apparatus showed the extremely decrease of surface resistivity at certain meteorological situations. Analysis showed that the cause is aerosol from near cooling towers which contained unknown material as corrosion inhibitor and which caused the high conductivity. The great difficulties were caused by the strong icing at warming. In both cases the application of measuring apparatus facilitated to find the cause of relevant defects which could be removed by working precautions [2].

5. CONCLUSIONS

Pollution of environment in certain areas is increased in such measure that it becomes dangerous and has its consequences not only for living nature but also for technical equipment [4],[5]. Developed equipment enables us to follow the surface resistivity in exposed energetical insulators. Obtained information enables us to prepare the competent working precautions not only for managing the situation, but also as long-term solution. By analysis of courses it is possible to show what types of outside factors have the greatest influence on surface resistivity. This equipment was developed for measurement of conductivity of external insulations and obtained results can be used also for evaluation of cumulative influence of pollution on conductivity of surrounding

environment. Developed equipment may be preliminary installed on the places that require observation from the point of view of pollution by chemical materials, which in cooperation with atmosphere humidity create conductive electrolytes. After these measurements the time of taking of samples for chemical analysis of pollution, that requires much expensive devices, can be determined [3]. By use of a greater number of this type equipment on various places, the distribution of pollution in the given locality may be observed, or the source of pollution can be localised.

6. REFERENCES

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